CODE OF PRACTICE FOR THE DISCHARGE OF PRODUCED WATER FROM COALBED GAS OPERATIONS

[in effect July 1, 2005]

Contents

PART 1 – INTERPRETATION AND APPLICATION

1 Definitions and interpretation

PART 2 – DISCHARGE OF PRODUCED WATER

2 Where produced water may be discharged
3 General design and construction requirements
4 Discharge of produced water into perennial streams
5 Discharge of produced water into seasonal streams
6 Discharge of produced water to the ground
7 Points of discharge
8 Maximum discharge, contaminants and registration information

PART 3 – MONITORING, RECORD-KEEPING AND REPORTING

9 Sampling and analysis
10 Produced water discharge analysis
11 Receiving environment baseline monitoring
12 Compliance and assessment monitoring
13 Special assessments – proximity to drinking water use and irrigation use
14 Record-keeping and reporting

SCHEDULE 1 – STANDARDS FOR PRODUCED WATER DISCHARGED TO PERENNIAL STREAMS

SCHEDULE 2 – STANDARDS FOR PRODUCED WATER DISCHARGED TO SEASONAL STREAMS

SCHEDULE 3 – PRODUCED WATER ANALYSIS

PART 1 – INTERPRETATION AND APPLICATION

Definitions and interpretation

1 (1) In this regulation:

"A Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition" means the guidelines by that title published by the minister;

"Act" means the *Environmental Management Act*;

"Aquatic Life Guidelines" and **"ALG"** mean

(a) the 30 day guideline for the protection of freshwater aquatic life specified, or if no 30 day guideline is specified, the maximum guideline specified in the British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, or

(b) if no 30 day or maximum guideline is specified in the British Columbia

Approved Water Quality Guidelines (Criteria), 1998 Edition, the 30 day guideline for the protection of freshwater aquatic life specified, or if no 30 day guideline is specified, the maximum guideline specified in A Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition;

"British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition" means the guidelines by that title published by the minister;

"British Columbia Laboratory Methods Manual: 2003" means the manual by that title published by the minister;

"coalbed gas" has the same meaning as in the *Coalbed Gas Act*;

"coalbed gas exploration and production industry" has the same meaning as in Schedule 2 to the *Waste Discharge Regulation*;

"discharger" means a person engaged in the coalbed gas exploration and production industry who introduces or proposes to introduce produced water into the environment in the course of conducting that industry;

"Drinking Water Guidelines" and **"DWG"** mean

(a) the guideline for the protection of raw, untreated drinking water specified in the British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, or

(b) if no guideline for the protection of raw, untreated drinking water is specified in the British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, the guideline for the protection of raw, untreated drinking water specified in A Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition;

"ground disposal facility" means the works used to discharge produced water to the ground by percolation through the ground;

"perennial stream" means a watercourse that from a point directly upstream of a point at which produced water is discharged or proposed to be discharged has observable water flow at all times;

"produced water" means water extracted from a coal seam or a formation contiguous to a coal seam that

(a) originates from within the coal seam or contiguous formations,

(b) is pumped out in advance of and in aid of the release of gas from the coal seam, and

(c) is produced in the course of a coalbed gas exploration and production industry operation;

"proper ecological function", in relation to a seasonal or perennial stream, means the maintenance of adequate vegetation, landforms or large woody debris in or around the stream that are able to dissipate the energy of high water flows, thereby reducing erosion, maintaining good water quality, improving flood-water retention and groundwater recharge and providing habitats that support greater biodiversity;

"publish" includes posting on a publicly accessible website maintained by the minister;

"qualified professional", in relation to a duty or function under this code, means an individual who

(a) is registered in British Columbia with a professional organization, is acting under that organization's code of ethics, and is subject to disciplinary action by that organization, and

(b) through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function;

"receiving environment baseline monitoring" means documenting, using field sampling and surveys, the condition of the part of the environment that may be affected by a proposed discharge of produced water;

"seasonal stream" means a watercourse that between a point at which produced water is discharged or proposed to be discharged and its confluence with a perennial stream

(a) has intermittent observable water flow each year, and

(b) is associated with a water table;

"sensitive-stream habitat features" includes fish spawning beds and fish overwintering pools;

"total dissolved solids" means the quantity of dissolved material in a water sample, expressed as milligrams per liter (mg/L), and determined using the laboratory analytical method entitled "Residue, filterable (TDS), 1.0 µm" found in the British Columbia Laboratory Methods Manual: 2003;

"trace elements" means all periodic table elements, unless otherwise specified in this code, that are found in

(a) the British Columbia Approved Water Quality Guidelines (Criteria), 1998 Edition, or

(b) A Compendium of Working Water Quality Guidelines for British Columbia, 1998 Edition;

"Waste Discharge Regulation" means the *Waste Discharge Regulation*, B.C. Reg. 320/2004.

(2) Produced water is prescribed as a waste for the purposes of paragraph (g) of the definition of "waste" in the Act.

PART 2 – DISCHARGE OF PRODUCED WATER

Where produced water may be discharged

2 Produced water may be discharged under this code only to

(a) a perennial stream,

(b) a seasonal stream, or

(c) the ground by percolation through the ground.

General design and construction requirements

3 (1) A discharger must evaluate options for potential beneficial uses of produced water before beginning any discharge of produced water under this code of practice.

(2) A discharger must locate the point of discharge for produced water to a perennial stream or a seasonal stream so that there are no negative impacts on sensitive-stream habitat features.

(3) A discharger must ensure that the works for a direct discharge to a perennial stream are designed and located to achieve maximum dispersion and mixing.

Discharge of produced water into perennial streams

4 (1) Produced water may be discharged into a perennial stream only if

(a) the flow of the perennial stream directly upstream from the point of discharge is sufficient, at all times, to provide a minimum of 10:1 dilution for the total produced water discharged by the discharger into that perennial stream, and

(b) the requirements of this code and the standards specified in Schedule 1 are met.

(2) Produced water may not be discharged into a perennial stream in a manner or quantity that impairs the proper ecological function of the perennial stream or otherwise causes excessive erosion.

(3) A discharger must ensure that a discharge of produced water into a perennial stream is treated, if necessary, to remove iron and manganese precipitates so that discoloration in the perennial stream is minimized.

Discharge of produced water into seasonal streams

5 (1) Produced water may be discharged into a seasonal stream only if

(a) the seasonal stream, when flowing, flows directly into a perennial stream,

(b) the flow of the perennial stream at its confluence with the seasonal stream is sufficient at all times to provide a 10:1 dilution of all the produced water discharged to the seasonal stream, and

(c) the requirements of this code and the standards specified in Schedule 2 are met.

(2) Produced water may not be discharged into a seasonal stream in a manner or quantity that impairs the proper ecological function or otherwise causes excessive erosion of

(a) the seasonal stream, or

(b) the perennial stream into which the discharge of produced water is or will be conveyed.

(3) A discharger must ensure that a discharge of produced water into a seasonal stream is treated, if necessary, to remove iron and manganese precipitates so that discoloration in the seasonal stream is minimized.

Discharge of produced water to the ground

6 (1) Produced water may be discharged to the ground by percolation through the ground only if

(a) a ground disposal facility is used,

(b) the total dissolved solids in the produced water immediately prior to discharge is less than or equal to 2 times the total dissolved solids in the underlying ground water, as determined under section 11 (2) (a) (ii), to a maximum of 4 000 mg/L,

(c) the total suspended solids in the produced water immediately prior to discharge is less than or equal to 25 mg/L, and

(d) the requirements of this code are met.

(2) A discharger must ensure that the rate of discharge to a ground disposal facility, plus any direct precipitation on the ground disposal facility, does not exceed the capacity of the ground disposal facility.

Points of discharge

7 (1) A discharger must not locate a point of discharge

(a) into a perennial stream or a seasonal stream, within 5 km upstream of an existing drinking water withdrawal point, or

(b) to the ground, within 2 km of

(i) a downstream drinking water withdrawal point on any nearby streams, or

(ii) an existing drinking water well,

unless the discharger has complied with section 13 (1).

(2) A discharger must not locate a point of discharge into a perennial stream or seasonal stream within 2 km upstream of an existing irrigation water withdrawal point, unless the discharger has complied with section 13 (2).

Maximum discharge, contaminants and registration information

8 (1) The maximum amount of produced water that may be discharged from a well is 1850 m^3 a day.

(2) The contaminant that is subject to a fee under this code is the total suspended solids in the produced water at the maximum set out in

(a) Schedule 1 if the discharge is to a perennial stream,

(b) Schedule 2 if the discharge is to a seasonal stream, and

(c) section 6 (1) (c) if the discharge is to ground by percolation through the ground.

(3) A person must register under section 4 of the *Waste Discharge Regulation* for the purposes of an exemption under that section in relation to this code and must include with the other information required under section 4 (2) of that regulation a record of

(a) the number of wells from which the person discharges produced water into perennial streams,

(b) the number of wells from which the person discharges produced water into seasonal streams, and

(c) the number of wells from which the person discharges produced water to the ground by percolation through the ground.

PART 3 – MONITORING, RECORD-KEEPING AND REPORTING

Sampling and analysis

9 A discharger must ensure, with respect to any monitoring under this code, that

(a) all sampling and flow measurements are carried out in accordance with the procedures described in the "British Columbia Field Sampling Manual: 2003", published by the Ministry of Water, Land and Air Protection,

(b) all analyses are carried out in accordance with the procedures described in the British Columbia Environmental Laboratory Manual: 2003,

(c) all sample collection and hydrometric gauging is carried out under the supervision of a qualified professional,

(d) the interpretation and reporting of all monitoring results is carried out by a qualified professional,

(e) the minimum analytical detection limits are 1/3 of the applicable standard specified in Schedule 1 or 2 or the reporting trigger specified in Schedule 3, or lower,

(f) all monitoring includes a program of quality assurance and control designed by a qualified professional, and

(g) the analysis of all samples is carried out by a registered laboratory as defined in the *Environmental Data Quality Assurance Regulation*, B.C. Reg. 301/90.

Produced water discharge analysis

10 (1) If a discharger proposes to discharge produced water under this code, the discharger must ensure that

(a) immediately prior to discharge, the produced water is analyzed by or under the supervision of a qualified professional for each parameter listed in Schedule 3, and

(b) the qualified professional designs a program for ongoing analysis of produced water to be discharged, which program includes the qualified professional's recommendation in respect of

(i) the parameters specified in Schedule 3 for which the produced water should be analyzed, and

(ii) the frequency of that analysis.

(2) A discharger must ensure that

(a) the program designed under subsection (1) (b) is carried out as designed by, and under the supervision of, the qualified professional,

(b) a report is prepared and signed by the qualified professional which summarizes results and evaluates associated environmental risks of the analytical program required under subsection (1) (b), and this report may be combined with the annual assessment report required under section 12 (1) (d) if appropriate, and

(c) if the results of an analysis carried out under this section exceed the reporting triggers specified in Schedule 3 or, in the opinion of a qualified professional, otherwise indicate a significant environmental risk, the discharger must submit the report prepared under paragraph (b) to a director within 30 days after receiving the analytical results, and the report must include the qualified professional's recommendation of whether the discharge should be continued or stopped and, if continued, the management options.

Receiving environment baseline monitoring

11 (1) If a discharger proposes to discharge produced water under this code, the discharger must first ensure that a receiving environment baseline monitoring program is designed by, and conducted under the supervision of, a qualified professional in accordance with subsection (2).

(2) A proposed discharger must ensure that

(a) the program referred to in subsection (1) is conducted for a least one year before discharging produced water and includes

(i) for a proposed discharge of produced water into a perennial stream or a seasonal stream,

(A) a survey of the quality of the water, aquatic biota, and riparian vegetation community, that may be impacted by the proposed discharge, and

(B) the evaluation of the flow in the stream,

(ii) for a proposed discharge of produced water to the ground by percolation through the ground, a survey of the quality of the groundwater that may be impacted by the proposed discharge, and

(iii) information on all potential options for the discharge of produced water, and

(b) a qualified professional prepares and signs a report that presents and summarizes the findings of the receiving environment baseline monitoring program, and includes recommendations for a program of ongoing receiving environment monitoring as required under section 12 (1) (b).

Compliance and assessment monitoring

12 (1) A discharger must ensure that

(a) a program to monitor the discharge of produced water into a perennial stream or seasonal stream or to the ground by percolation through the ground is designed to

(i) measure the quantity of flow in cubic meters per day (m^3/d), on a weekly basis, and

(ii) demonstrate compliance with the requirements and standards specified in this code,

(b) a program of ongoing receiving environment monitoring is designed and carried out to assess the nature and magnitude of environmental change that occurs as a result of the discharges,

(c) the monitoring programs referred to in paragraphs (a) and (b) are designed by, and carried out under the supervision of, a qualified professional, and

(d) an assessment report for each year in which the discharger discharges under this code is prepared within 90 days after the end of the year and signed by a qualified professional

(i) reporting the quantity of flow from each point of discharge for the year,

(ii) reporting each instance in the year of failing to meet a requirement or standard of this code, the actions taken to address each instance, if any, and a schedule for completing corrective action proposed by the discharger, if any,

(iii) providing an analysis of the nature and magnitude of environmental change that

(A) has occurred in the year, as measured under the program referred to in paragraph (b), and

(B) the qualified professional considers requires corrective action, and

(iv) reporting the results of the monitoring under the programs described in paragraphs (a) and (b) and section 10 (1) (a) and (b) for each year in which the discharger discharged produced water under this code and comparing each of those results with the results of previous monitoring under paragraphs (a) and (b), the results of the receiving environment baseline monitoring program under section 11 and, if relevant, the results of the produced water characterization carried out in accordance with section 10.

(2) If a bioassay required under Schedule 1 or 2 for discharges into a perennial stream or seasonal stream does not meet the standard specified in the schedule, the discharger must

(a) repeat the bioassay immediately on receipt of the results from the first bioassay, and

(b) notify a director within 72 hours of receipt of the results of the second bioassay if it also fails.

Special assessments – proximity to drinking water use and irrigation use

13 (1) For the purposes of section 7 (1), the discharger must ensure that

(a) an assessment of the effect of the discharge on the drinking water use is conducted, and a report is prepared, by a qualified professional, and

(b) the report

(i) includes an evaluation of the need for protective measures and management recommendations,

(ii) is approved by a director, and

(iii) is provided to the affected drinking water users.

(2) For the purposes of section 7 (2), the discharger must ensure that

(a) an assessment of the effect of the discharge on the irrigation water use is conducted, and a report is prepared, by a qualified professional, and

(b) the report

(i) includes an evaluation of the effects on irrigation use and management recommendations, and

(ii) is provided to the irrigation water users that use the existing irrigation water withdrawal point described in section 7 (2).

(3) A director may require that an assessment be conducted under this section even if the discharger complies with section 7.

Record-keeping and reporting

14 (1) A discharger must retain for inspection

(a) for a minimum of 5 years all monitoring and assessment data gathered under sections 10 to 13, and

(b) for the duration of a particular coalbed gas exploration and production industry project, all assessments and reports gathered or generated under sections 10 to 13 in relation to the project.

(2) A discharger must provide to the director, on request, monitoring or assessment data recorded or maintained under this code.

(3) On request, a discharger must submit to a director

(a) the produced water analysis report prepared under section 10 (2),

(b) the receiving environment baseline monitoring report prepared under section 11 (2) (b),

(c) the annual assessment report prepared under section 12 (1) (d), and

(d) the special assessment report on proximity to irrigation water use prepared under section 13 (2).

(4) A discharger must submit or post monitoring data to a website as and when instructed by the director.

(5) If, at any time, monitoring under this code indicates to a qualified professional that an environmental change requiring corrective action has occurred, the discharger must ensure that a summary report of the occurrence is

(a) prepared by the qualified professional setting out

(i) the qualified professional's recommendation for corrective action, and

(ii) the discharger's estimate of when the corrective action can be completed, and

(b) submitted to a director within 30 days of receiving the analytical results.

SCHEDULE 1

STANDARDS FOR PRODUCED WATER DISCHARGED TO PERENNIAL STREAMS

(Section 4)

1 The standard specified in Column 2 of this Schedule opposite each parameter in Column 1 must be met in produced water at the point of discharge to a perennial stream.

Item	Column 1 Parameter	Column 2 Standard
1	Total Dissolved Solids	≤ 4000 mg/L
2	Total Suspended Solids	≤ 25 mg/L
3	Chloride (dissolved)	≤ 1500 mg/L
4	Temperature	The lesser of 20°C and 5°C above the temperature in the perennial stream above the point of discharge. For perennial streams warmer than 20°C, the standard equals the stream temperature.
5	Dissolved Oxygen	≥ 3.0 mg/L
6	Toxicity to Fish: Rainbow trout 96 hour single concentration bioassay in 100% effluent	< 50% mortalities
7	Toxicity to Invertebrates: *Daphnia magna* 48 hour single concentration bioassay in 100% effluent	< 50% mortalities

SCHEDULE 2

STANDARDS FOR PRODUCED WATER DISCHARGED TO SEASONAL STREAMS

(Section 5)

1 The standard specified in Column 2 of this Schedule opposite each parameter in Column 1 must be met in produced water at the point of discharge to a seasonal stream.

Item	Column 1 Parameter	Column 2 Standard
1	Total Dissolved Solids	≤ 2000 mg/L
2	Total Suspended Solids	≤ 25 mg/L
3	Temperature	The lesser of 20°C and 5°C above the temperature in the seasonal stream above the point of discharge. For seasonal streams warmer than 20°C, the standard equals the stream temperature.[1]
4	Toxicity to Fish: Rainbow trout 96 hour single concentration bioassay in 100% effluent	< 50% mortalities
5	Toxicity to Invertebrates: *Daphnia magna* 48 hour single concentration bioassay in 100% effluent	< 50% mortalities
6	Dissolved Oxygen	≥ 3.0 mg/L if >10:1 dilution available in seasonal stream, ≥ 5.0 mg/L if not.
7	Chloride (dissolved)	≤ 400 mg/L
8	Boron (total)	≤ 1.0 mg/L

Notes for Schedule 2:

1 If there is no flow in the seasonal stream, the temperature standard in Schedule 1 applies as if the point of discharge were the point at which the seasonal stream meets the perennial stream.

SCHEDULE 3

PRODUCED WATER DISCHARGE ANALYSIS

(Section 10)

Parameter	Reporting Trigger
Flow (m^3/d)	No trigger
pH	≤ 6.5 or ≥ 9.0
Temperature	No trigger
Total Dissolved Solids	No trigger
Major Cations (Na, K, Ca, Mg, Fe, Mn)	No trigger
Major Anions (HCO_3, Cl, SO_4)	No trigger
Trace Elements	$\geq$ 10 times ALG[1,2]
Total Suspended Solids	No trigger
Dissolved Oxygen	No trigger
Nitrogen as ammonia, nitrite, and nitrate	No trigger
Polycyclic Aromatic Hydrocarbons (PAHs)	$\geq$ 10 times ALG for each compound[1]
Volatile Hydrocarbons $w_{6\ 10}$[3]	$\geq$ 15.0 mg/L
Extractable Petroleum Hydrocarbons $w_{10\ 19}$[4]	$\geq$ 5.0 mg/L
BTEX (benzene, toluene, ethyl benzene and xylenes)	$\geq$ DWG for each compound
Uranium	$\geq$ 20 µg/L
Radium 226	$\geq$ 0.6 Becquerels/L
Lead 210	$\geq$ 0.1 Becquerels/L

Notes for Schedule 3:

1 If 30-day guidelines have been established, the reporting trigger will be this value and need not be determined by sampling 5 times in 30 days.

2 The ALG for many trace elements must be calculated from the hardness of the receiving stream, which must be sampled at the same time.

3 Analysis must use the Analytical Methods, Extractable Petroleum Hydrocarbons in Water by GC/FID, Version 2.1, July 1999 director's protocol under section 64 of the Act.

4 Analysis must use the Analytical Methods, Volatile Hydrocarbons in Water by GC/FID, Version 2.1, July 1999 director's protocol under section 64 of the Act.